APRIL/MAY 2024

DPH21/GPH21 — MATHEMATICAL PHYSICS - II

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Write Cauchy-Riemann equation in polar form.

2. Define analytic function.

3. Write the two dimensional diffusion equation under steady flow of heat.

4. Give any two physical problems where Laplace differential equations were used.

5. Find the Fourier sine transform of $\sin ax$.

6. Mention the properties of Fourier transforms.

7. What is a cyclic group? Give examples.

8. Distinguish between homomorphism and isomorphism.

9. What is priori posterior probability?

10. Determine the probability that a leap year selected at random contains 53 sundays.

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) State and prove Cauchy's integral formula.

Or

(b) Discuss the various properties of complex line integrals.

12. (a) Obtain the solution for the differential equation $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$.

Or

(b) Solve $\frac{\partial^2 u}{\partial r^2} + \frac{1}{r}\frac{\partial u}{\partial r} + \frac{1}{r^2}\frac{\partial^2 u}{\partial \theta^2} = 0$.

13. (a) Find the Fourier transform of the function $f(x) = Ne^{-\alpha x^2}$ where N and α are constants.

Or

(b) Find inverse Laplace transform of $\frac{1}{s^2(s^2+\omega^2)}$.

14. (a) Show that three cube roots of unity form an abelian finite group under multiplication.

Or

(b) Construct the character table for C_{2v}.

15. (a) State and prove Laplace-de-Moivre theorem.

Or

(b) Discuss the various properties of the normal curve.

PART C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Expand $f(z) = \sin z$ in Taylor series (a) $z = 0$ and (b) $z = \frac{\pi}{4}$.

17. Obtain D'Alembert's solution to the wave equation for the vibrating string and give its physical interpretation.

18. Find the Laplace transform of (a) $\frac{\sin at}{t}$ (b) $\frac{\sin t}{t}$. Also check whether the transform of $\frac{\cos at}{t}$ exist.

19. Discuss Irreducible representation and character of $SU(2)$.

20. Obtain Poisson distribution; hence show that mean and variance of a Poisson distribution is each equal to m.